The Air Line Pilot

September, 1957

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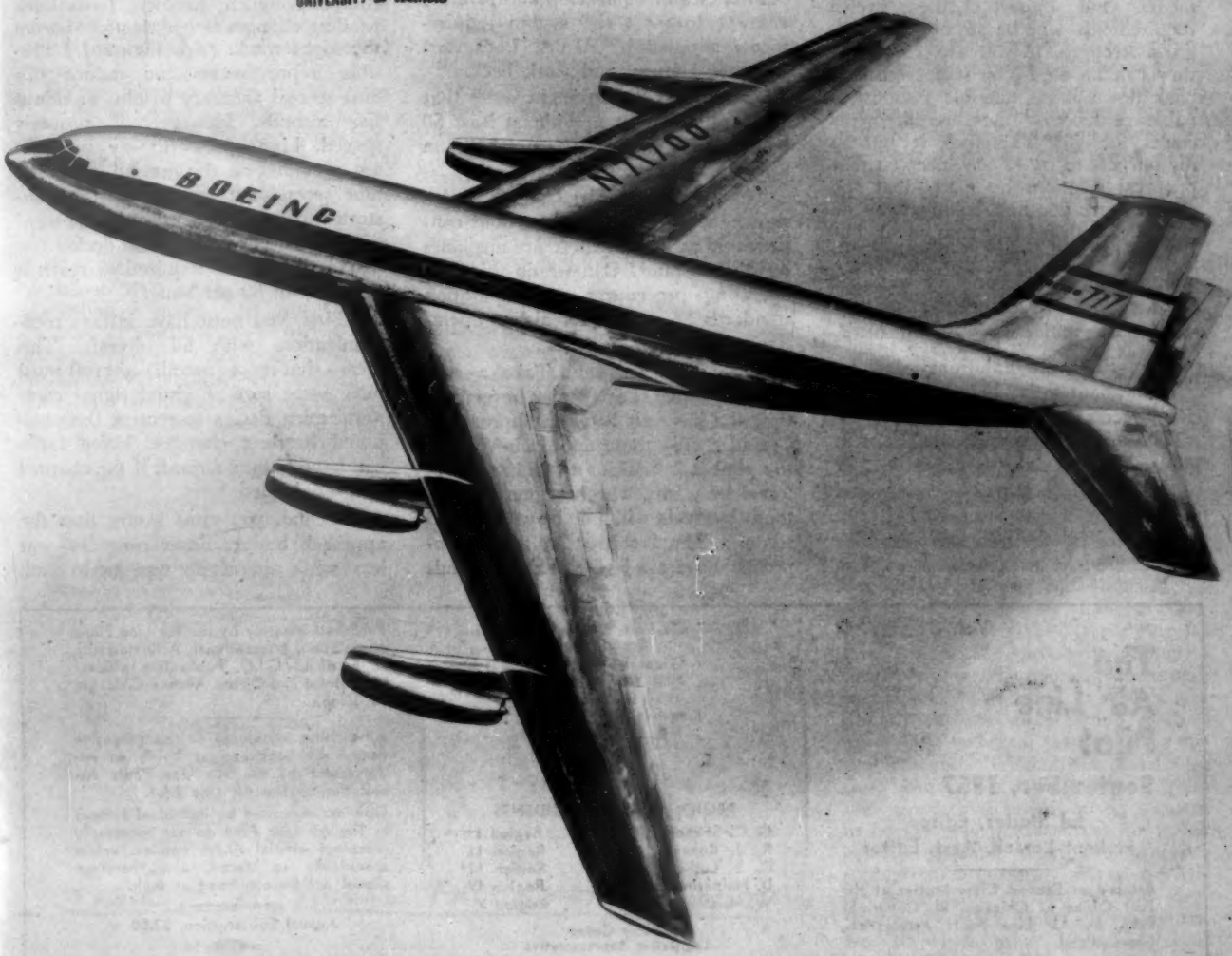

Boeing 717

An Operating Concept For ATC Solutions

This, Says The Author, Isn't Necessarily The Only Answer. There May Be Better Ones, But It Is At Least One Method Of Getting A Toehold On The ATC Problem

By Capt. S. P. Saint
AA, Member, ALPA ATC Committee

Last November the Air Traffic Control Committee of ALPA presented to the ALPA convention a set of twelve operating requirements that an Air Traffic Control system must meet. They were adopted and written into the policy manual of the Association.

Now these requirements standing alone mean nothing. Requirements can't survive indefinitely in a vacuum. There must soon follow some knowledge of what it will cost (in time and dollars) to meet a given set of requirements. Your support of these twelve requirements will be strong, and will grow stronger, if you are convinced they can be met. You will eventually back down if no tangible system capable of meeting these requirements comes to light. Therefore, it will be my purpose to try to convince you that practical solutions do exist—that the requirements you have adopted can be fully met with existing equipment that can be introduced in an evolutionary manner. *I hope to convince you that we don't have to wait seven years for relief as one major study has indicated.*

Specific Solutions

I am about to lay before you a specific, recommended solution of the ATC problem with suggested steps in implementation. This is the essence of more than fifteen years of concentrated study of this knotty business. I do not present this as the only possible solution. There may be better answers. The intent of this paper is to show that there is *at least one way* of getting a toe-hold on the air traffic control problem.

I have no axe to grind, no patent applications, no connection, direct or indirect with any manufacturer, or with any government organization. I am an American Airlines pilot and I am a member of the ALPA Air Traffic Control Committee.

Breaking It Down

First of all *let's develop an operating concept* to meet the system requirements adopted by ALPA. Let's start with the runway and work back.

▶ **The First Requirement** states that "The system must provide at least 60 landings and 60 take-offs per hour on dual runway airports."

The question is this: Can we feed a runway with 60 landings per hour continuously as long as there are airplanes wanting to land? Can we do this with operating procedures and separation standards acceptable for airline operation?

I feel sure we can. Take a stop watch into one of our major towers and time the intervals between approaches. Consider only those approaches where the pilot is in position to make any interval he wants. The best one third of these intervals will fall between 50-60 seconds. The fact that ⅓ of our approaches average less than sixty seconds apart proves that we can average 60 landings per hour if we can position aircraft on approach all the times as accurately as pilots can ⅓ of the time in clear daylight.

The Air Force VOLSCAN computer long ago demonstrated the ability to vector individual flights onto the final approach path with an accuracy of plus or minus *nine* seconds. This accuracy is achieved by locking an automatic tracking circuit on the radar target, feeding the resultant speed and heading to a computer which, in turn, feeds back heading changes to lengthen or shorten the flight track. *(See Figure 1.)* Possible improvements can reduce this *nine* second accuracy to plus or minus *five* seconds. However, if properly spaced, high speed runway turn-offs are provided on the ground, even the nine second accuracy already demonstrated can put a continuous flow of 60 aircrafts per hour on the deck.

Two things are required to reach a flow rate of 60 per hour:

- First, you must have instant communications with all aircraft. This means that most (not all) aircraft must have some sort of visual signal communication device to receive the computed heading changes. Voice radio can handle some aircraft if the channel is lightly loaded.
- Second, you must insure that the approach hopper never runs dry — at least while aircraft are wanting to land.

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Feeding The VOLSCAN Computer

In *Figure 2* I have shown a typical arrangement for feeding a VOLSCAN Computer. Three feeding points are shown. It could be two, or perhaps four. These are the same feeding points we use to feed the present manual radar system. The minimum flight track from any one of these points to the runway should not be more than four minutes at a standard maneuvering speed of say 150-160 knots.

Note that the minimum track time in each case is the same short route you would fly in clear weather if there were no other traffic in the air. Note also that the length of the flight track can be varied so as to delay a flight by *any precise amount* up to 3 minutes — or more depending on how much air space you can afford to use in this operation.

Suppose now three airplanes hit these feeding fixes at the same instant. No problem. The computer gives one the least time track and stretches out the other two to fall at correct following intervals.

So we handled three simultaneous arrivals. But what about four, five, six or more. All right, let's take eight aircraft all estimating to arrive at the same moment.

The first four aircraft can leave the feeding fixes as they arrive. No. 1 gets no delay; No. 2, 1:00 minute; No. 3, 2:00 minutes; and No. 4 gets his path stretched 3:00 minutes. When No. 5 arrives over the fix, his signal says: "Make a 360 degrees turn in the holding pattern." After this 360 the VOLSCAN computer will stretch his path the additional 2:00 minutes he needs to lose. Thereafter No. 6, 7, and No. 8 are "called out" of the back stretch of the holding pattern in time to latch onto the computer about midway between the least time track and the longest computer track to the runway.

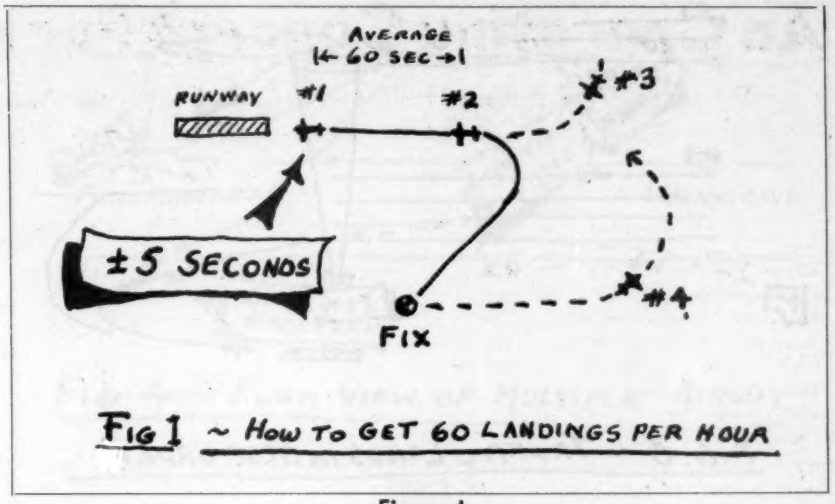


FIG 1 ~ HOW TO GET 60 LANDINGS PER HOUR

Figure 1.

Step one, then, in smoothing out traffic flow is "path stretching" — "tromboning" the controller calls it — in the last 4 to 7 minutes of flight.

Controlled Turn

▶ **Step Two** involves a *controlled* turn in the holding pattern at the feeding fix.

But suppose more than eight airplanes all want to land at the same time? Passengers are most inconsiderate. They all want to leave for home at the *end* of a business day. And sales departments almost always give in to this nonsense. So everyone wants to take-off at 5:00 p.m. And we frequently have more than eight airplanes wanting to land at the same time.

▶ At this point **Step Three** comes into play. It is not logical to rush into a terminal area at high speed only to mill around in a holding pattern. So we arrange to slow the flight down early. A simple calculation can determine the time at which a flight should slow down to minimize the time in the final holding pattern. At a precalculated point between the terminal-area-gate and the feeding fix the pilot is advised to bank the fires and slow the beast down.

In steps one, two and three, then, we have produced 10 minutes of adjustability. If we need more, we can let flights hold longer in the feeding stacks or in secondary feeding stacks — *but this is undesirable.* So let's apply...

▶ **Step Four:** This is the Flow Regulation system spelled out by Special Working Group-5 in 1950. (Air Coordinating Committee Document: "Air Traffic Control and the National Security.") You can relax. I am not going to describe how SWG-5 Flow Regulation works. It's simple to apply — simple that is, when you have a system at the end of the line to absorb and smooth out the short period fluctuations. One technical man studying the problem said, "We'll throw that in for free." Not only is SWG-5 Flow Regulation simple in concept, but it happens to be the only phase of the air traffic control problem that is clearly described in a currently effective ACC document. This method of Flow Regulation also meets **ALPA's Requirement No. 10** which asks: Where delay is unavoidable the pilot should be given

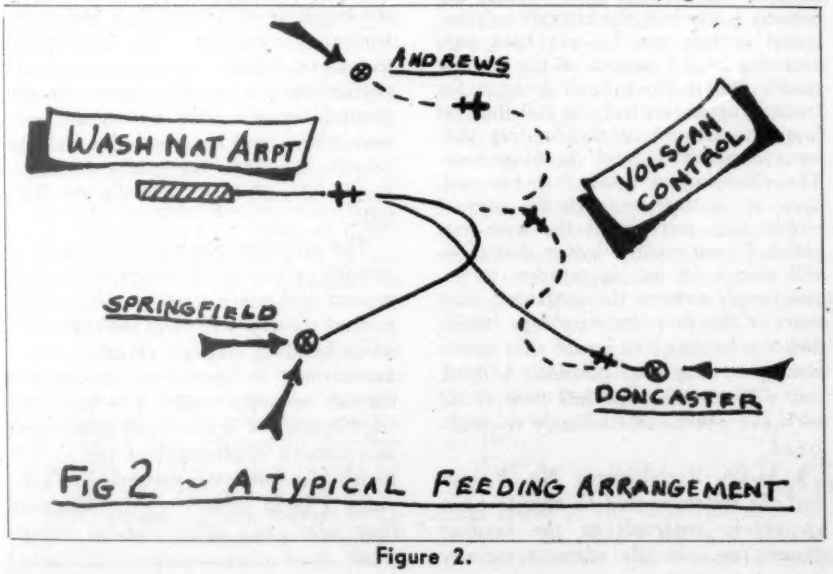


FIG 2 ~ A TYPICAL FEEDING ARRANGEMENT

Figure 2.

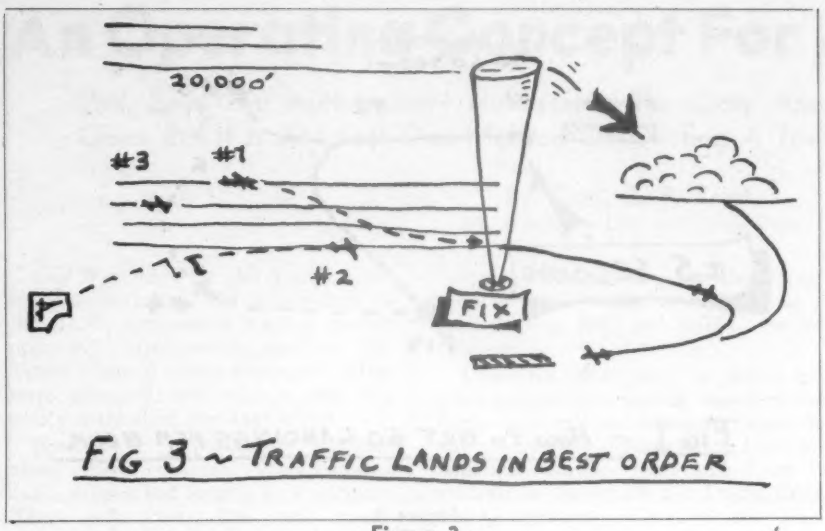


FIG 3 ~ TRAFFIC LANDS IN BEST ORDER

Figure 3.

his choice of absorbing the delay — 1) on the ground before take-off; 2) by cruising slower enroute; or 3) by holding close to the terminal area.

A Profile View

We've looked at the terminal area inbound operation in plan view. Now let's look at it in profile *(Figure 3)*. There are several things to note here:

- First, and most important, *every aircraft has an assigned block of sky big enough to hold in until he leaves the feeding fix on final.*
- Two, the nature of the final radar vectoring or VOLSCAN type operation is such that aircraft need not always feed from the bottom of the stack. The jet, for example can leave the same fix at 20,000 feet, still only four minutes from touchdown. The jet can follow the same flight track over the ground at the same speed as the other traffic during this operation. The jets that will be used commercially can stay above 20,000 feet until a definite landing slot is assigned. They can mingle at random with piston types with no reduction in the 60 per hour traffic flow to the runway. This meets **ALPA Requirements 7 and 8.**

Similarly you will note that the DC-3 (they'll probably still be flying in 1975) can climb up from a nearby airport, mill along in the lower altitudes, and be fitted into the landing stream when he gets there. Other faster traffic will ride by over his head in the meantime.

Most significant is the fact that we are talking of feeding a runway with 60 aircraft per hour using basically the same system you are using now. *There is no operating policy involved that you haven't already accepted.* We're just going to implement it with tools to make it work.

Other ALPA Requirements

As you have noted we are discussing the ALPA requirements in random order. Take . . .

▸ No. 4 next. This is the one that says: "When the flow of traffic to a runway has been interrupted by weather or other cause, the system should be capable of absorbing the interrupted flights in safe holding positions. *When the runway is reopened, the system should be capable of re-establishing a full flow of traffic to the runway, in approximately the original priority order, within four minutes."*

Look at the approach pattern again in plan view *(Figure 1)*. When the runway is blocked, the aircraft on computed vectors can be put back into altitudes at the bottom of the feeding stacks. When the runway is open for business again, control can call the first four aircraft out of the holding patterns immediately and simultaneously. The chances are good that one will show up in time to reach the runway within four minutes of the time you called. If you want to insure that there will always be one in position to go, you simply control the outbound turn times of the first four airplanes (while they are holding) to insure that one is always coming into position. I think you will see that *the full flow of 60 per hour can be immediately re-established.*

▸ **ALPA Requirement No. 9** says that *the system should be able to open up precise intervals in the landing stream for take-offs* when a runway is used for both. You will see that the computer can be given an order and the flight paths of all aircraft not already on final can be stretched out to make a precise interval for one or more departures.

▸ **Requirement No. 6** asks that the system be capable of *fitting an overshoot or emergency back into the landing stream without delay and without any reduction of the 60 per hour flow.* Any controller who has run radar approach control will tell you this is a simple matter in the manual system. The computer will do it more precisely. The electronic brain will continue to feed arrivals into the final approach slot until the emergency is in position to be fitted into the landing stream. There should not be a single wasted landing interval.

▸ **Requirement No. 11** says *the system must not suffer loss of safety or efficiency on reaching saturation . . .* I think we proved that we have met this requirement when we discussed stopping and starting traffic flow.

▸ **Requirement No. 12** says that *"the system must handle aircraft that do not have the airborne end of the new system."* As we have already pointed out, what we are proposing is essentially the same as the present manual method of radar approach control. This means that a certain percentage of flights can be carried through the system by voice radio.

In order to keep the approach hopper from running dry a third item is needed in addition to the VOLSCAN computer and the air-ground-air data link specified for 60-per-hour approach control. We urgently need to mechanize the handling of control data from controller to controller. This is essential to relieve control workload, eliminate bottlenecks and provide a means on the ground for accepting automatic position reports and for processing data to prepare signals for automatic transmission to aircraft equipped with the data link.

The proposed control machinery will provide a means of inserting position reports and other data manually. The ground displays will alert the controller when heading changes or other clearances must be passed to unequipped aircraft by voice radio. The proposed combination of operational procedures and control mechanization (to be explained in following paragraphs) provides a good answer to the itinerant flyer who can't afford special equipment.

We will approach the goal of 60 per hour in proportion to the number of aircraft that are equipped — and might reach the full sixty with perhaps 25% of the aircraft still hand-carried through the system by voice radio.

▶ **Requirement No. 5** says: *The control system must be able to divert flights anytime at pilot request.* This operating requirement is very disconcerting to some engineers. One poked his head in my door sometime ago to say: "Maybe when you pilots get off your high horse and submit to some authority from the ground—maybe then we can build you a system."

All I can say is: I cannot foresee the day when a controller is going to tell me when and where to divert under what circumstances. This is one prerogative that must always remain in the cockpit. Neither an electronic brain nor a human controller on the ground can take over this decision-making function. In the system we are proposing here, a pilot can change his mind without creating a problem. At anytime prior to the final feeding fix a flight can divert from the pattern of one airport to the pattern of another without any change in the flow to either runway.

New York-Style Airport Operations

If you have been keeping score, I think this leaves two requirements not covered.

▶ **Requirements No. 2 and No. 3** state that *we should be able to operate airports as close together as they are in New York on a full, non-interfering basis. And that "the system must allow flights to climb, cruise, and descend within the normal best performance ranges of the various aircraft types."*

This is a tough question. So far I have been expounding a specific operating philosophy. It is all good in theory, *but is there enough sky to give everyone* (everyone but those on final) *a block of sky big enough to hold in?* Can you let aircraft climb and descend the way they want to in and out of Idlewild, Newark, LaGuardia, Teterboro, Westchester and Mitchell fields? These nasty questions have to be answered before you can sensibly talk of implementing the operating philosophy with hardware.

We haven't time for a discussion of this critical point. All I have time to say is that I have made an extensive (42-page) study applying the operating concepts of this proposal to the New York area of 1975. These briefly are the steps gone through in this study:

First decision: There should be excess capacity everywhere in the system from the landing runway back. Next, the basic capacity of an airlane was calculated for the worst condition—a temporary stoppage after which each airplane in turn, when cleared to move on, was presumed to be in the worst position in the holding pattern. The existing airports in the New York area were used in this model problem. CAA and ATA statistics gave anticipated peak hour loading for the area for 1975. This, with a cushion factor added, turned out to be 540 operations per hour.

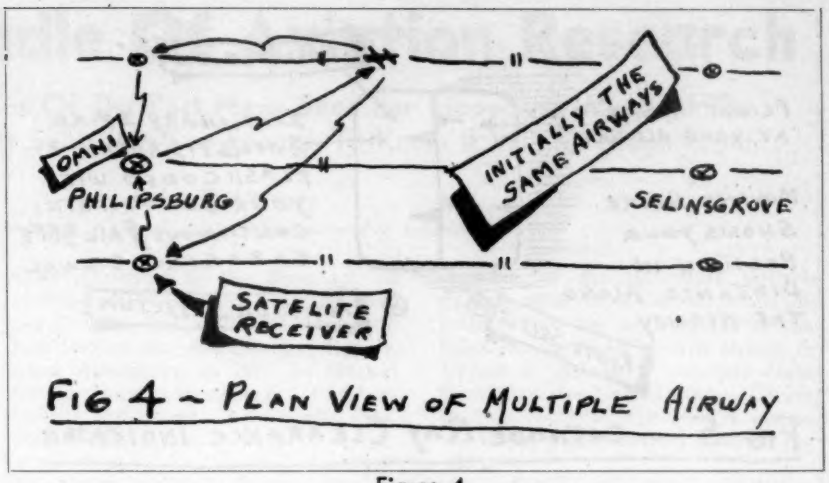


Figure 4.

From the same sources distribution of traffic by routes and distribution by aircraft types was determined. I then decided that short term peaks of traffic (less than one hour) might run 50% higher than CAA peak figures based on hourly counts. So I added 50% more traffic on each route; then, after applying the anticipated breakdown by aircraft type categories, I added another 50% for short term peaking of particular type categories. *In setting up the problem enough air lanes were provided to accommodate all of these peak loadings all of the time, or 100% excess capacity above anticipated peak area loading of 540 operations per hour.* And this was without taking advantage of the possibility such a system affords in switching airlane assignments to accommodate shifting load patterns.

The conclusions of this study were definitely affirmative. You can control traffic on this basis in the N. Y. area of 1975. When mileages were added up, the 1975 flight tracks averaged only ½ mile more per flight than IFR mileages in use when the study was made in 1956.

With a few minor exceptions, aircraft were able to climb and descend and cruise as the slide rule says they should. In fact, I think it accurate to say that this type of control—*when properly implemented*—will give more freedom of movement than we have today with 5 times the traffic volume.

Data-Transfer-And-Display Sets

The first stage of implementing the system I have described operationally, involves adding to the existing radar and voice radio a Data-Transfer-and-Display equipment for controllers and a VOLSCAN type computer. Nothing in the aircraft in the first stage. There is no purpose whatsoever in talking about data links to the airplane or automatic position reporting while the controller is still scribbling on scraps of paper and passing data by telephone—a means as slow as the ox-cart by comparison with modern technology.

I wish I had time to discuss this first phase implementation with you. I hold a detailed proposal in my hand. Again, time doesn't permit, so I'll have to save it for another day. You will be interested, however, in a bit of history regarding the Data-Transfer-and-Display-Equipment spelled out in this paper. As Chairman of SWG-13 I called together a Controller Task Group. Present around the table were some of the best brains in the ATC business. The average experience of this group was well over ten years in actual air traffic control operation. The Air Force and ATA were represented (because they had experienced controllers on their payrolls). The rest were all from CAA—the Technical Development Center at Indianapolis, the New York Center, Washington Center and the Division office in Washington.

Controller Task Group's Work

The Controller Task Group of SWG-13 was well along in preparation of a

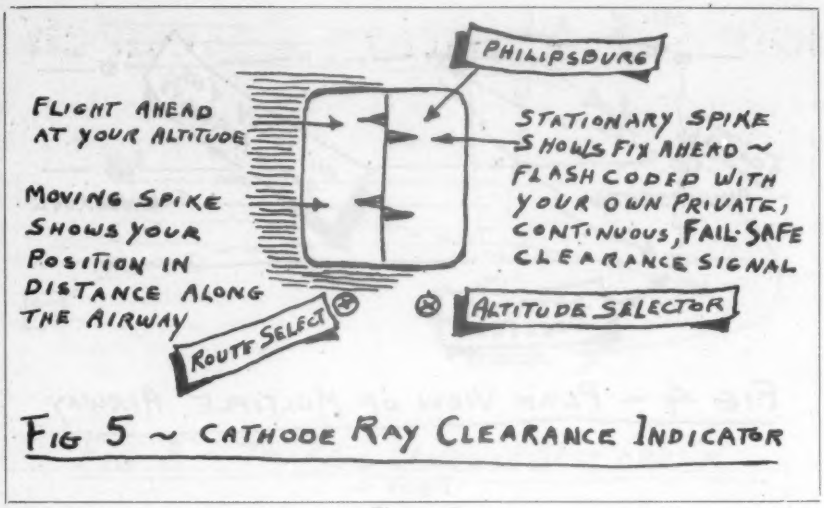

PHILIPSBURG
FLIGHT AHEAD AT YOUR ALTITUDE
MOVING SPIKE SHOWS YOUR POSITION IN DISTANCE ALONG THE AIRWAY
STATIONARY SPIKE SHOWS FIX AHEAD ~ FLASH CODED WITH YOUR OWN PRIVATE, CONTINUOUS, FAIL-SAFE CLEARANCE SIGNAL
ALTITUDE SELECTOR
ROUTE SELECT
FIG 5 ~ CATHODE RAY CLEARANCE INDICATOR

Figure 5.

detailed specification for a Data-Transfer-and-Display-Equipment. We had partially completed a time and motion study comparing what we were asking for with the old operation. *First results showed a more than 50% reduction in the tangible, measurable controller workload.* Telephone time in the normal operation would drop to near zero. Perhaps most important of all, the assignment of altitudes and airspaces would have been interlocked to prevent the hazardous human errors that are more prevalent with each passing day.

Never have I seen a more optimistic promise of a real break-through in ATC. So what happened? The engineer-dominated CAA top side—this was before Lowen and Pyle—pulled the rug out. The CAA boys on the Task Group suddenly couldn't cooperate any more. They couldn't agree to anything specific. Only vague generalities. The CAA had a program at Indianapolis and we were muddying up the water. *That equipment could have been in live service test today and would probably have paid for itself in a few short years.*

Concludes Committee's Studies

I finished the job the Committee was not allowed to finish and here it is. It represents the *first step* in implementing the system I have been talking about. The analyses that I have made indicate that this first stage implementation would break existing traffic bottlenecks and give us time for development of succeeding stages. This is further borne out by a study of the Bell Telephone Laboratories. In their study ("Air Traffic Control Communications—Final Report Task A, Part 2" under date of December 31, 1955) BTL gives findings of their analysis of the Boston-New York airway made for the Air Navigation Development Board. The following quote is from the BTL report under the heading of *"Capacity of Airspace"*:

"Configuration of the airways enters into capacity in a remote way since it will have some effect on communications, but saturation of the airspace is not a factor in any discernible manner at this time. . . . It seems evident that insofar as saturation of airspace is concerned a well ordered or planned system, having some degree of automation, could greatly increase the use of the airspace even under present separation rules." Some figures were then given and the whole question summed up this way: *"It (the study) does indicate the existence of a vast reservoir of air space available on the present airways for exploitation by some degree of automation."*

If the foregoing is true, then we have every reason to believe that automation can be applied with benefit in the immediate future. No new operational procedures or control standards need be argued ad infinitum in committees. *We can apply off-the-shelf devices to currently approved control procedures and solve the problems in areas like New York for several years to come.*

The second stage implementation ties in the airplane, with a special box in the airplane reporting position automatically and receiving signal clearances from the ground. Initially the second phase should also use the same fixes and routes in use today, but later parallel lanes should be available for equipped aircraft while flying machines still limited to the older omni system fly on the center track.

A box of electronic stuff at the omni site interrogates the airplanes along the route. About ten times every second a box in your airplane will transmit an altitude coded reply. As shown in *Figure 4*, the reply from your DC-6 is received by two sattelite receiver stations on the ground and relayed to the main station (at an omni site). Distance measurement along these two paths gives the ground, by triangulation, a continuous and accurate position on your flight. This continuous position report will have all the accuracy of a radar position. *It is independent of your airborne navigation devices.* It is not subject to precipitation interference and will provide a double check of the primary radar where radar is used.

The box in the airplane is basically a DME and can have a switch to throw it from standard DME to signal system operation in areas where the signal system has been installed on the ground. As you will see in a moment, the ATC signal indication in the cockpit will still give you distance along the route when operating on the signal system. Further, the nature of the signal indication will give you constant proof that the system is working OK.

The Cockpit Indicator

Now let's look at the cockpit indicator. *(Figure 5.)* I think most of you are familiar with the "scope" of an engine analyzer. As you know, this sort of low persistence cathode ray tube can be as bright as needed for daylight operation. In trying to visualize specific electronic hardware I have chosen this type indicator because it is inherently *fail-safe.* If the signal is properly transmitted from the ground it will be properly received in the airplane—or not received at all. The airplane does not have to repeat the signal back to the ground to check accuracy. This is a tremendous simplification electronically and saves weight and complication in the airplane.

Stationary "spikes" appear to the *right* of the vertical trace. These represent the fixes along the airway you are flying. Moving "spikes" on the left side of the trace represent *all the aircraft flying IFR on your airway at your altitude.* (There will be a special

(Continued on Page 20)

NACA — Cradle Of Aviation Research

Modest Aviation Predictions Of The Past Have Been Far Exceeded. What Of The Future? Like Wilbur Wright Said: We See Enough To Know It Will Be Magnificent

By John F. Victory

Executive Secretary, National Advisory Committee For Aeronautics

Fifty years ago, in 1907, in a statement made to the Aero Club of America on "the relations of weight, speed and power of flyers," Wilbur and Orville Wright wrote, "It is evident that the limits of speed have not as yet been closely approached in the flyers already built, and that in the matter of distance, the possibilities are even more encouraging. Even in the existing state of the art it is easy to design a practical and durable flyer that will carry an operator and supplies of fuel for a flight of over 500 miles at a speed of 50 miles an hour."

In the half century since that modest prediction, man has accomplished objectives unforeseen by even the most optimistic. Airplane performance was improved rapidly by advancing technology of the new century. In turn, the demands of the airplane led to creation of strong, light alloys, high octane gasoline, high output engines, and special operating equipment, such as radio, radar and autopilots.

European Advances

Designers were at first the airplane's inventors, then its engineers and scientists. While early development of the airplane in the United States depended largely upon amateur inventors, in Europe there was quick recognition of the gains to be had from aeronautical laboratories staffed by competent engineers. The French were among the first to utilize scientific techniques in aeronautics. Not long after, aeronautical laboratories were established in Russia, Germany, Italy, and by 1909, in Great Britain.

The backward position of the United States in scientific aeronautical research was, of course, recognized by numerous Americans, some of them prominent, who saw in the situation a national disgrace. However, many felt that any special government concern with such development might imply belligerent intentions.

Proposed In 1911

A national aeronautical research laboratory was proposed by Capt. Washington Irving Chambers, USN, as early as 1911. The two men who were most influential in the drive for an aeronautical laboratory were Alexander Graham Bell, who, with Mrs. Bell, had formed the Aeronautical Experiment Association in 1907 to support the airplane experiments of Glenn Curtiss and others, and Charles Doolittle Walcott.

Dr. Walcott, as successor to Prof. Samuel P. Langley, Secretary of the Smithsonian Institution, induced the Board of Regents of the Smithsonian to re-open the Langley Aerodynamical Laboratory and to form an Advisory Committee for Aeronautics in 1913 to direct its work. That Advisory Committee held only four meetings, being put out of business by a decision of the Comptroller of the Treasury that, because it was not established by law, public funds could not be expended on its activities. Dr. Walcott diplomatically and effectively persuaded the Congress of the need for establishing the present National Advisory Committee for Aeronautics as a separate government agency. The Act, approved March 3, 1915, prescribed its function "to supervise and direct the scientific study of the problems of flight, with a view to their practical solution." Dr. Walcott was one of the original 12 members appointed by President Wilson, was the Chairman, Executive Committee, from 1915 to 1919 and was Chairman of the entire Committee from 1919 until his death in 1927.

Early Activities

One of the first projects undertaken by the NACA was a survey of facilities available for aeronautic research. Although it was found a number of institutions had facilities which could be used, only Massachusetts Institute of Technology and the University of Michigan had regular courses of instruction and experimentation.

For several years, the work of the NACA was largely advisory. The Committee played a leading role in getting the country's airplane builders to organize and to prepare for production requirements to meet our contemplated involvement in World War I. It was largely responsible for establishment of the procedure whereby patents were cross-licensed, thus dispelling the fog of controversy and litigation that had been a serious deterrent to growth of aviation manufacture in the United States. Lacking its own facilities, the NACA assessed the needs and sponsored research elsewhere.

In 1916 the Committee studied the feasibility of carrying mail by air, and recommended that service be started on an experimental basis.

In succeeding years it led efforts to provide legislation necessary for orderly development and growth of commercial aviation. In many other ways the Committee gave advisory service, on such varied matters as provision of insurance for aviators, naming of flying fields after persons who had "rendered conspicuous service," aerial mapping techniques, and the selection of an airport site near Washington, for "accommodation of transient aviators."

First Center Built

Beginning in the fiscal year 1917, the NACA began construction in Virginia of its first research center. The establishment was formally dedicated as the Langley Memorial Aeronautical Laboratory, on June 11, 1920, a date that may be considered as the real beginning of the Committee's own program of aeronautical research, conducted by its own staff in its own facilities. The first annual report of the NACA included seven reports, covering research sponsored by the Committee, including results of a study on the behavior of *aeroplanes* (it was not until later that *airplane* became accepted usage) in gusts, by the Massachusetts Institute of Technology. Part I gave the results of an experimental analysis of inherent longitudinal stability for a typical biplane written by J. C. Hunsaker, a young Naval Officer, who two years before had set up a graduate course in aeronautical engineering at M.I.T.

Forty years later Dr. Hugh L. Dryden, director of the NACA, observed that "many of the major problems of the aircraft of the future are old problems in new dress. . . . The problems

of stability and control of current and future aircraft are describable in the same conceptual framework . . . which Hunsaker applied in NACA Report No. 1. There are, however, great changes in the superstructure, in what Bryan described as the approximations to the air pressures to which the planes and other parts of the machine are subjected. For our future airplanes we must assure stability not at speeds of 40 to 90 mph, but at speeds extending from 100 to 1,000 mph."

Parenthetically, it should be noted that Dr. Hunsaker, who was in charge of naval aircraft design in World War I, was a member of the Committee in 1922-23. In 1938, he was again appointed to the NACA, this time by virtue of his leadership in science. His effective service with the Committee since then has been unbroken; only last fall he completed 15 years as Chairman, being succeeded in that office by James H. Doolittle.

In 1921, the Committee decided to build a new type of wind tunnel. Utilizing compressed air, it would allow for "scale effects" in aerodynamic model experiments. This tunnel represented the first of many bold steps by the NACA to provide its research personnel with equipment to press forward the frontiers of aeronautical science.

New Tunnel

In 1927, another tunnel, large enough to be used in testing full-scale propellers under conditions of flight, was put into operation. The first and most spectacular of the aeronautical advances resulting from use of this new facility soon became known as the NACA cowling for air-cooled radial engines. Speed increases of as much as 20 per cent could be obtained, without additional power. More positive information about the best location of engine nacelles was soon gained, as were other needed data.

In 1933, looking at the gains resulting from research at Langley Laboratory, the Committee said: "No money estimate can be placed on the value of superior performance of aircraft in warfare, nor can a money estimate be placed on improved safety. The value in dollars and cents of improved efficiency in aircraft resulting from the Committee's work can, however, be fairly estimated. For example, the results of researches completed by the Committee within the last few years show that savings in money alone will be made possible in excess annually of the total appropriations for the Committee since . . . 1915."

ALPA President On NACA Committee

ALPA President C. N. Sayen is a member of the National Advisory Committee for Aeronautics (NACA) Committee on Operating Problems.

NACA's technical aid committees are composed of specialists whose collective talents represent leadership in virtually every branch of the physical sciences. They serve in a personal and professional capacity and are chosen on the basis of their technical ability, experience, and leadership in a special field. They provide technical assistance, review research in progress at NACA and other laboratories, recommend research projects, and assist in coordination of research programs.

Cites Accomplishments

In retrospect, one marvels that so much could be accomplished in those years by so few. At the beginning of 1930, for example, the total employment at the Langley Laboratory was only 81. And yet, as A. J. Sutton Pippard of the University of London observed in 1935, "many of our most capable design staffs prefer to base their technical work upon the results of the American NACA."

Through the thirties, the NACA continued to pioneer in aeronautical research. There was growth, too, in the number of technical workers and laboratory facilities. The growth, however, was at a slower rate than in Europe. Even as late as July, 1939, the NACA's total complement was only 575, including 195 professionals. Especially with respect to facilities for engine research, there was inadequacy. In 1939, a Special NACA Committee, headed by Charles Lindbergh, had called for such facilities, but it was not until June, 1940, after Belgium and Holland had been overrun that Congressional authorization for the new propulsion laboratory, to be located at Cleveland, Ohio, was forthcoming. A year earlier, approval had been given for construction of a new aerodynamics laboratory at Moffett Field, Calif.

World War II

The NACA's effort, in World War II, was of necessity devoted for the most part to applied research. It was essential that "quick fixes" be found to make existing airplanes better performers, and production engines more powerful. The considerable backlog of design date, fortunately, could be readily applied to such subjects as low-drag wings, high-speed propellers, stability and control, and improved systems for cowling and cooling engines. During these years, the civil service staff was expanded from hardly 500 to more than 6,000.

Between December, 1941, and December, 1944, the NACA worked on 115 different airplane types. Perhaps the best assessment of the value of this work was by the late Frank Knox, at the time Secretary of the Navy: "New ideas are weapons of immense significance. The United States Navy was the first to develop aircraft capable of vertical dive bombing; this was made possible by the prosecution of a program of scientific research by the NACA. The Navy's famous fighters—the Corsair, Wildcat and Hellcat are possible only because they were based on fundamentals developed by the NACA. All of them use NACA wing sections, NACA cowling methods, NACA high-lift devices. The great sea victories that have broken Japan's expanding grip in the Pacific would not have been possible without the contributions of the NACA."

Supersonic Flight

With the end of war, the most urgently sought goal was attainment of practical supersonic flight. The NACA led in the conception and planning of the high-speed research airplane program, which resulted in the first supersonic flight in 1947 by then Capt. Charles E. Yeager, USAF in the Bell X-1. In 1953, the NACA's Scott Crossfield became the first man to fly twice the speed of sound, in the Navy-sponsored Douglas D-558-II Skyrocket, and soon after, Yeager flew the X-1A, 1,650 mph. In 1956, the stainless steel Bell X-2 was flown by Majors Kincheloe and Apt to speeds greater than man had ever ventured. The Air Force has not announced the results, but the press, quoting "reliable sources," has reported that the X-2 surpassed 2,100 mph (more than three times the speed of sound) and on other flights, reached 120,000 feet.

A great step forward was made in 1951, when the NACA's John Stack devised a way to build a wind tunnel that would be useful in the transonic speed range, where previously tunnels had been ineffective because of "choking." An early fruit from this development was the discovery and experimental verification of the "area rule" by Richard T. Whitcomb. Already, both fighters and bombers of

(Continued on Page 23)

To Whom It May Concern . . .

Ten Million Or More Years Ago, When Our Ancestors Had Learned To Walk Upright And Swat Down Their Supper With A Club, They Learned The Value Of Organization

By Capt. F. E. W. Smith
Canadian Air Line Pilots Association

So you have resigned from the organization. You got mad at it and the people who are running it and you have quit. You did your best. You paid your dues for many years. You came to meetings—not too often, perhaps. The d----- chairman always called them on nights when you were out or when you had better things to do. Besides they are frustrating and dull. You give up a whole evening of your time just to listen to a bunch of guys argue in circles and get nowhere. And nobody listens to you anyway.

That's the trouble—no one ever listens. You took a real interest in this issue and you told everyone just what you thought about it. When the manager came around you stood right up in front of the members and you told him off, but good. You warned him if this thing went through you would quit. Might as well have saved your breath as bother; they went ahead with it anyway.

You've Quit

Well, from here on in they can go it without you. You aren't going to pay good money to an outfit that won't even listen to you. Things have been getting bad for a long time now. They ram these things through without thought or care of the rights of democracy. Whatever they decide they do and they never listen to what you think about it. Sure, a guy is supposed to put up his dough and be a good member. But as long as they do things this way the quicker the outfit goes broke the better. If more fellows would do what you have done—quit—then maybe they would take some notice, or maybe they wouldn't have an organization.

Would that be bad? You doubt it. You can't think of a thing the outfit has got for you that the company wouldn't have given anyway. And every time a real issue comes up the fellows come apart at the seams. You don't blame them. You wouldn't strike for the crazy deals they cook up.

No, you won't come back. You know everyone will castigate you for what you have done, but you will just have to put up with it. You have made your decision and it is final. It is right.

That is the point. Is it right?

We don't think so. Sure, we know you have a beef, but we don't think you have done the right thing in quitting. You have talked a lot about democracy and your democratic rights and the way they have ignored these. We don't think you know what a democratic right is. We think you have proven this by doing what you have done—by quitting. Stay with us here a bit and let us explain.

The "Why" In Organization

Before getting into democracy let's first find the "why" in organization. Pretty obvious, isn't it, and what is more, it has been going on a long, long time. Ten million or more years ago, when our revered ancestors had learned to walk upright and swat down their supper with a club—before they knew the use of fire—they learned the value of organization. A man could chase a deer all day and wind up tired and hungry. But if he teamed up with some other fellows they could box the game in, make a kill, and eat. Lesson one in organization.

After a while they got some new ideas. Instead of chasing deer they could find some character with a nice cave full of bear. They could gang up on him, take his cave, his bear and his women and this was technologically superior to tramping around the wet bush. So the fellows with caves had to organize, too—or be dead.

Development Traced

Organization has come a long way since those dim, distant, uncomplicated days. The early bands developed into tribes and tribes into nations. Chiefs became kings and even emperors. The simple organization, developed to get food or to keep from being food, grew into a government which ruled over the people. It made them work and made them learn. It collected taxes.

On The Cover

A new short-to-medium range jet airliner, the Boeing 717, was announced recently by the Boeing Airplane Co., to be offered to air line operators for delivery in 1960. It is designed to operate economically on flights of from 200 to 1,700 miles, cruising at speeds of from 550 to 600 miles per hour, at altitudes of from 25,000 to 40,000 feet. Passenger capacity will be from 88 in first class versions to 130 in tourist configurations.

According to a Boeing spokesman, the 717 will be identical in external dimensions to the 707-120 Jet Stratoliner (wingspan, 130'10"; length, 128'10"; tail height, 38'7"; cabin width, 12'4"), and will be built at the Transport Division's Renton, Washington, plant on the same production jigs and tools and on the same assembly line as the 707 series.

Different Maximum Gross Weights

The major difference between the 717 and 707-120 will be in maximum gross weight. While the 707-120 weighs 247,000 pounds at take-off, the new 717 will weigh only 185,000 pounds.

The lower maximum gross weight has been achieved by the 717's lighter structure and smaller fuel load, which are compatible with the ranges for which the new airplane is designed.

The basic configuration is designed around four Pratt & Whitney advanced JT3 engines. However, engines such as the General Electric advanced J79 and others in this power class also may be used.

The 717 will be capable of take-offs and landings on runways presently available at the major and intermediate airfields of the world, the Boeing announcement said. C. A. R. field length required for full gross weight take-off will be 5,400 feet with dry power ratings. Landing at 150,000 pounds will require a C. A. R. field length of 5,500 feet.

It prescribed their behavior and punished them if they did not conform. Because it became big and complex, the boss man needed help to run it and he gathered about him a group for this purpose who held great power over the ordinary folk. Because it is always easier to prosper by taking advantage of someone who doesn't have a private army than it is to work, these types—and the kings too—soon enslaved all the people to themselves. The little guy wasn't much better off than he had been before organization, when he sat in a cave mouth and roasted bear.

Eventually the smarter of the serfs said to heck with this. They organized into guilds and in these they declared: "We will all stick together. We have a price for our work and we have certain rights and privileges, and if you won't pay our price or respect our privileges, we won't fix your clock or cut your hair. Not even if you kill us." And because even kings needed to know the time and couldn't go around looking like Rasputin, they made it stick.

The guild was the granddaddy of the trade union and the professional association. It was organized to protect its members from the ruthless exploitation of those for whom they worked. All professional associations and trade unions today exist for that same purpose.

Employer Vs. Employee

You think times have changed and that we don't need this sort of protection today? There isn't much difference between the robber barons of the middle ages and our corporation executives. Sure, our moderns don't live in moated castles with dungeons and torture chambers. Nor do they clank about the country slaying dragons for fair maidens. But they do exist to turn a profit for their companies, and the easiest way to profit—today and always—is to take it out of *you*. And it is human nature to take the easiest way. If you think this is preaching class war then look to yourself. Have you ever voluntarily boosted the wages of your cleaning woman or your gardener? Do you, of your own free will, raise the allowance of your fair wife or of little junior? You do? You are unusual.

No one can blame the boss for buying his help as cheaply as they will let him, or for working them as hard as they can stand. The only ones to blame are those who allow themselves to be treated this way. And the only way people who are employed can protect themselves from such treatment, is by organizing. It is as important to be organized today as it was in the days when others looked on you as meat. Unorganized, gentlemen, you are dead.

So much for the why of an organization like ours. Its need is obvious. It has as much right to claim your support as has the government, for it serves the same purpose in a different field—that of protecting you from your fellow (?) man. And who is to protect you from it? You say your democratic rights are ignored. What are democratic rights?

To dip back briefly into history, the early governments, wherein all power was held by one or a few men, were tough things to live with. They set rules arbitrarily, judged without trying, respected neither property nor privilege, punished fearsomely. For talking out of turn your tongue could be cut out. If the right guy coveted your property he could take it; if he coveted your wife he could have you disposed of or leave you to rot and die in some dismal dungeon. Through the centuries a lot of brave men have died in the field, or have been strung up on gallows, or had their heads lopped off, in protest of these excesses. Their sacrifices have given us our democratic rights.

We Have Come A Long Way

Today we have the right to vote, the right to choose who will rule over us, the right to compete for and if successful become a ruler ourselves. We have laws which protect our property; we cannot be imprisoned without charge or sentenced without fair trial. We have the right to say what we think about almost anything almost anywhere. We have the right to work at what we choose and where we choose, the right to succeed or to become a bum. We have the right to an education. In organizations like ours, we also have the right to rule ourselves, by means of the majority vote.

What, then, are not democratic rights? Secession is not one. Nowhere and at no time has any person or persons ever had the right to secede from the state—nor has anyone just right to secede from an organization which is of vital importance to him and which must work for him whether he belongs or not. Why not? Why don't you have a right to quit if you don't like the way things are going?

Here we go again back to first principles. We can explain it by alluding to a state government and then relating it to our own organization. You cannot run a government without making someone mad. If you tax the rich and let the poor off, the rich get mad. If you hit the poor and let the rich get richer, the poor become upset. Whatever is done, someone is mad. If, when a citizen got mad he said: "I quit," if he said: "I pay no more taxes, obey no more laws, serve in no more armies, support no more schools," it would only be a matter of time before the state would disintegrate; the organization would be destroyed. For more and more men would follow this course as successive efforts of government made first one, then another, then another, mad, and still more would follow it for its obvious advantages. This is anarchy. Because the state organization is essential, because it cannot live with such internal rot destroying it, it is obvious that no one can be permitted to quit in this way. If you should try it you would be thrown into jail. You can, in our country—but by no means in all others—leave us if you wish, but you cannot continue to live here and not be a part of us.

Benefits Of Organization

While our organization does not have the power of a state to force your unwilling participation, making it impossible for you to do what you have done, it does have moral right on its side. In its way it is as vital to you as is the state. It must work for you whether you belong to it or not. The wage agreements it wins belong to you as well as to the members. The privileges it bargains for are also yours. It needs protection from your anger just as does the state. For it is no more possible to run our Association and keep everyone happy, than it is to run the government without making some people mad. By quitting you are the anarchist, rotting us from within. If, in time, your action and that of many others like you destroys us, you will have truly sabotaged the organization you most need. You are trying to cut off your own hand.

If you are sincerely upset over the way things are going, instead of quitting take a more active interest. Come to meetings and speak your mind. You will be elected to office, because all organizations like ours are constantly crying for members who will take an interest, do some work, and hold office. Then you will have more say in how things are run and be better able to present your views. In time you may be President.

You are mad and you have taken action to display your displeasure. The way you have chosen is completely undemocratic. If you did this with the state you would be imprisoned. We cannot do anything like that to you, but we can say — emphatically — you are wrong!

The Confessions Of A Tobacco-holic

Indomitable Dave, Soaring Along At High Altitude, And Not Wishing To Cash In On Loss-Of-License, Hits On A Sure But Simple Cure For Tobacco-holics

By Dave ("I've Got A Secret") Kuhn
TWA

After reading Bob Buck's article in the February, 1957, issue of THE AIR LINE PILOT, "Why An Air Line Pilot Quit Smoking," I've been doing a lot of thinking about this smoking thing. There have been quite a few other things written about it lately, too. Like the fatigue factor, or, how smoking and high altitude don't mix. It isn't like the old days when old "mailbags" was pushing back and forth over the Rockies with the U. S. Mail. It seems like another *S* should be added to the familiar three. Seniority, Sex and Salary is no longer enough. Now it is Seniority, Sex, Salary and Smoking to take care of us air line pilots, who, alas, are tobacco-holics.

Now I admire Bob and anybody else that can quit smoking. I've even known some of them. I understand our President Clancy Sayen took the vow and laid off the weed several years ago. Must have been because of all that high altitude stuff at the Home Office with no flight-time limits.

Impressive Stuff

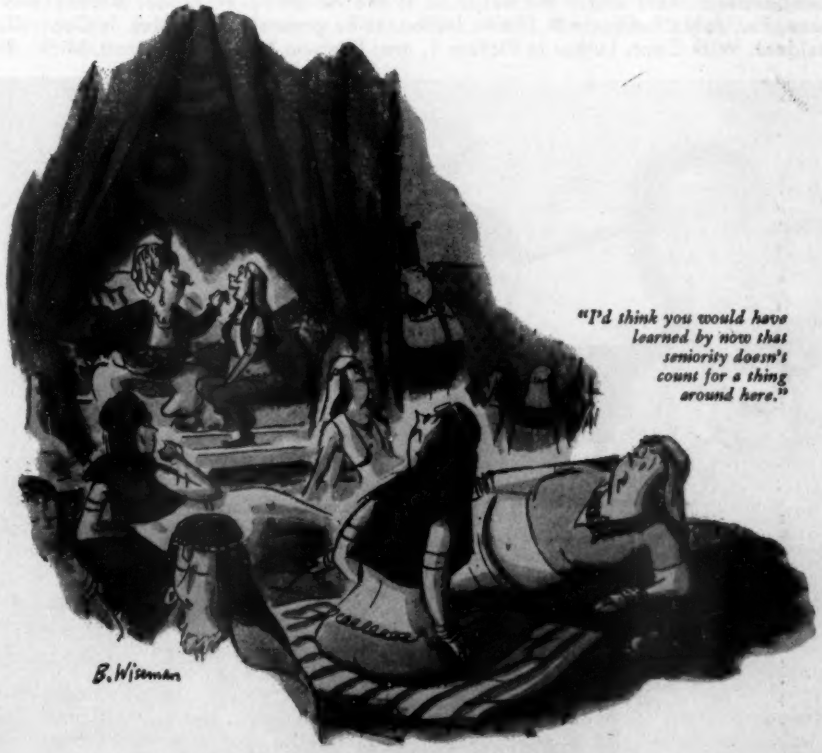
All of this is pretty impressive. The more I read and the more I see, the more interested I get. I've done a lot of soul-searching lately while I've been searching in my pocket for my cigarettes. I'm convinced: air line pilots shouldn't smoke. The important thing is: why do we smoke and how can we quit? I think I owe it to my brother pilots to pass on my experience and the secret I have discovered. I would have sold it to *Confidential,* but it's much too sensational to turn loose on the general public. It should be kept a professional secret.

First, I must confess that after twenty-five years of smoking and twenty-five concurrent years trying to quit, I have decided I am an addict—hooked—a cigarette fiend. Dope, liquor, gambling and wild women are evils that childhood teachings provide some defense against. Not so with tobacco. Radio, TV, newspapers, stage and screen all demand that we load our bodies with that smooth, mild blend of Turkish and domestic weed. Any measure of success in sports, business, love, war or peace is dependent on what brand is used in any field of endeavor.

Selling The Kids

The tobacco companies concentrate on the grade schools for new customers. Us oldsters they already have. In baseball, there is a cigarette that enables a kid to pole a home run at will. Big game hunters, sport car racers, tennis players and golfers all owe success to their special brand. Of late the old pros in golf seem to favor the filter. After holing a forty-foot putt on the eighteenth to win the "closed open," they approach the TV with a pack of "smoother flavor flip top filter." There are 20,000 filters in each (count them) fully packed, easy on the draw, selected blend cigarettes. It filters the smoke on the way to the throat. Anybody that plays golf can understand this. Even though some of the goodness is filtered out, one can't afford to choke on a short putt. To the kids that aspire to radio, TV, screen or stage, fifteen minutes of listening and looking will reveal which brand will assure them of making the grade. One brand can even change a country couple into a wealthy, carefree, romantic pair. They are usually in a woodland and presto, when they fire up they suddenly "go modern."

I have smoked every make of cigarette there is. My quest, naturally, has been for the success and joys that smoking brings. I even switch to cigars or pipes in the fruitless hope to capture that rich and satisfying pleasure. A pipe is worse than a dog since it bites



"I'd think you would have learned by now that seniority doesn't count for a thing around here."

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707 Production Underway

The first two of 151 Boeing 707's, ordered by 13 air lines, are shown in Boeing Airplane Company plant at Renton, Wash. Both will be delivered to PAA. A third is currently in the construction jig at Boeing.

ALPA Sponsors National Model Airplan

ALPA again this year, as it has during previous years, sponsored three trophies and awards in the National Model Airplane Championships, held under the auspices of the Academy of Model Aeronautics at the U. S. Naval Air Station Willow Grove, Pa., July 29-August 4. Shown below, as he presented trophies, is Capt. C. E. Luther (CAP), ALPA Region III Vice President. With Capt. Luther in Picture 1, are: Sherwin Maslowe, Detroit, Mich., 3rd; Marvin Lannholm, Galesburg, Ill., 2nd;

The ALPA Camera

ALPA Employee Family

Recent Honorman of his company was Seaman apprentice Eugene W. Balog (right), former part-time employe at Home Office. He was chosen by his instructors, company commander and fellow recruits at Great Lakes Naval Training Center. Eugene worked for ALPA while attending school. Shown with him following graduation ceremonies, are (l. to r.) Comdr. H. L. Vaughan; William, his father; Arthur, his brother, who also works part-time at Home Office; and Mrs. Balog, his mother. Eugene's aunt, Ruby Svidron, is a long-time employee in the Home Office Addressograph Dept.

Model Airplane Championships Awards

(first place winner not present at awards) in Indoor Hand Launch Glider Sr. Picture 2: Manuel Anrade, Oakland, Calif., 3rd; Lawrence Conover, Cedar Rapids, Iowa, 2nd; William Dunwoody, Brooklyn, N. Y., 1st; in Indoor Hand Launch Glider Open. Picture 3: William Pease, Ann Arbor, Mich., 2nd; Joe Morrisey, Ozone Park, N. Y., 3rd; (first place winner not present at awards) in Indoor Hand Launch Glider Jr.

as it growls. I even used to roll my own from a mixture called "bridge tobacco." This blend is scraped up from wooden bridges (when dry) and is composed of one-half splinters and one-half of other ingredients not uncommon where horse drawn vehicles abound. Nothing fancy, to be sure, but it will make a smoke. It will also burn holes in your clothes. Cowboys are deft in the art of rolling them.

I'll admit, it must be me. Cigarettes have failed to make me into the man my Mother expected I would be. I probably belong to that group that eventually burns the household up by engaging in nocturnal smoking. I have missed completely all the joys and pleasures that smoking brings to successful people.

The Morning Blues

Each morning when my bare feet hit the floor, or dispatch puts in a hurry-up call while I'm still asleep, I grope, through bloodshot eyes, for what is left of that cool, mild, less irritating, satisfying good Turkish and domestic blend package. My throat is parched. Sleep was incompatible with gases that kept the stomach and chest constricted. Pains (could be more gas) around the heart area shoot out in the arms and hands. My mouth tastes like the bottom of a bird cage. I tried all the stomach aids—no good. The first drag on that "so good and so good for you" starts the action. A severe fit of coughing shakes the rafters and drowns out the tardy alarm clock. Blackie, the dog, growls once and heads for a less exposed area. The household is awake. By now the eyes bug out, tears course down purplish cheeks. Veins cord on the neck, breath is indeed dear. Oftentimes it is necessary to hit the bath to get rid of some of yesterday's smoking enjoyment.

Quit smoking? Sure, I have tried all the cures. All the tablets there are. Ones that are supposed to get rid of the urge and others that work on a miserable-if-you-do and miserable-if-you-don't principle, that make you as sick as the smoking. One came close. You are directed on the first day to smoke all you want up till lunch time. Then after lunch, take a tablet with one-half glass of water and never smoke again. They guarantee that by taking a tablet after each meal and *never smoking* again the habit will leave you. My mistake was to fire up one after the week to see if I was cured. I wasn't. Hard candy will give one a sore mouth and fat. No good either.

I know of no person, that is an addict, that would like to quit. We are urged to buy them by the carton. To perpetuate the sales, the cigarette companies give samples away. They flood the helpless veterans with free smokes in the hospitals. The government provides clinics and cures for dope addicts, and alcohol. For us smokes, nothing. We are supposed to use will power where there is none. However, I know a fellow who quit for a whole year. I was surprised to see him fire one up and asked why. He advised that he did not want his will power to get the better of him. Then there are the hearty souls that can quit with no trouble at all. A few of them do. One such bragged that he quit and never had a bit of trouble. I asked him how long he had been off the stuff. He says without batting an eye, "Seven years, thirteen months, eight days, nine hours and twenty-three minutes." So, it can be done if there is any will power left.

Taking The Cure

The withdrawal symptoms are worth mentioning here to any that do not have will power and want to quit. Of course, every waking moment you feel the need for a fag. There is a noted light-headiness or drowziness. Gradually the eyes clear up, the chest pains subside. Food tastes better and sleep comes easily. There is a noted absence of stomach gas, no coughing or sinus dripping. You can smell things long forgotten—some good, some bad. The most pronounced symptoms (third day) are more distracting. They are two-fold. First self-pity, the victim rationalizes that he has but few vices and that (watching TV) he should not deprive himself of the joys and success that smoking assures. Acute loss of memory is the second symptom in this third day. He completely forgets the coughing seizures, the chest pains, the wheezing, the insomnia, bad tastes, befogged eyes, nausea and chronic indigestion that smoking provides. After a week, I cannot say. Never got that far.

In recent years the medics have timidly uncovered some startling facts on what I have suspected for years. Smoking is not all that we have been led to believe. Research has revealed that nine out of ten cigarette smoking mice develop cancer. Since men and mice are identical in all respects, hence the rise in human cancer with the increase in cigarette smoking. Berger's disease and heart trouble are direct results of heavy smoking. Smokers die ten years sooner than others. The insurance folks have latched onto these findings, forcing us smokers to lie in order to get a policy. And of course, don't forget this high altitude business with us air line pilots. The doctors in presenting these facts were bucking big business. The newspapers, those sentinels of truth and light, buried medical reports in the automobile section. The half-page cigarette ads remain where no one can miss them—in the sports section. Also, to counteract these reports, the companies engaged some cigarette smoking doctors to refute the damaging evidence. Additionally, they developed the King Size filter tip. All this does, of course, is to add a nickel to the price of a pack and cause the addict to smoke twice as many to get the same results. No fools in big business.

The Solution

Is there an answer? I would be less than honest and more than a scoundrel if I did not tell it. It is so simple that someone with brains should have already hit on it. The answer is by substitution. When a baby sucks his thumb, it can be broken by having him suck his toe. When he is grown he can't reach his toe. When an MC annoys his viewers by pulling his ear, he may substitute by switching to his nose and so on.

Now then, the substitute for smoking cigarettes is *dipping Snuff!* Don't be doubtful. I have tried it and it has worked for the past week. Just think of what this switch can do for America. Mothers no longer will blind their feeding babies with hot cigarette ashes. We will live ten years longer, freed from Berger's disease, cancer and cardiac problems. The doctors in losing lots of cigarette smoking customers, will allow a competitive spirit dictate thoughts when rendering bills for professional services. Leastwise, our stay in the waiting rooms should be reduced proportionally. Life insurance will be reduced as we become better risks. Fire hazards removed gets lower fire insurance costs. Since the heart and cancer problems will no longer exist, we will not need drives to raise funds to combat same. This will leave more money for the Red Cross, Community Chest, Crippled Children, Boy Scouts, Girl Scouts, AID, CARE, Blind, Palsied, Spastics, Polish Relief, Hungarian Relief, United Jewish Relief, Flood Relief and Drought Relief (in season), Korean Relief, Cambodian Welfare and possibly other worthy causes that are recognized as legitimate tax deductions. Caution should be exercised because if there are too many deductions, the Congress will raise taxes in order

to provide more funds with which to subsidize production for creating huge surplus, that will be costly to store until a place can be found to dump them on the unsuspecting heads of peoples other than Americans. The law of supply and demand is very evident in this arrangement. The government demands the taxes and we supply them. It takes lots of money to save the world from the Commies even though some may suspect that Russia prefers that we saddle ourselves with bought friends.

The Hard Sell

The TV, radio, press, stage and screen will all do their part in making snuff hit the country with a splash. Doctors can endorse brands that contain vitamins. Dentists, others that have Irium as an ingredient. Advertisements and jingles can popularize to wit: "When you feel you are lagging, fill your lip with Copenhagen." "If you need a booster, take no other snuff but Rooster." "You should see our sweet Miss Harriot, when she skeets that Levi Garrett." "For the mustachioed dandy—'It leaves a drip on each tip'." There will be just lots of them.

The weaker sex, being more indulgent than men, should logically lead the switch. 'Twas the painted ladies of easy virtue that popularized hair bobs, slacks and cigarette smoking among other things. Nowadays no self-respecting female dast depart from these patterns of smartness. Men will not be slow to embrace snuff once milady points the way. I dare say there may be a few that might want to sniff it rather than dip it.

Believe me, it is the answer to stale air, ash trays with smouldering butts, and worker proficiency. Can't whistle and dip at the same time. Glittering gibbons that festoon public buildings will be placed at convenient intervals offering a challenge to scurrying executives in their daily pursuit of happiness. It is possible that even with some practice and much inherent ability, to make a "bull's eye" even in a trot. Managers of department stores can prevent jamming and crowding at the bargain counter by judicious placement of cuspidors. Stinking ash trays will give way in car, train and plane to receptacles capable of receiving something more durable. For people with family pride the home might well sport spittoons with the coat of arms emblazoned theron. Bear in mind, it's a good insecticide when strolling in the garden.

After the kids get the pitch, then cigarettes will be a thing of the past. And there is no other way. The spitball in baseball will again take its rightful place with little or no effort. Spitting for children will in no way cause a barn to burn up or a forest to sear when they sample a pinch of Dad's favorite. Rather the opposite—might even put a fire out. As for love, it will find a way.

Love And Snuff

Picture, if you will, with me, your favorite movie starlet in a torrid love scene. The huge boudoir resplendent (rich folks) with furnishings is revealed by subdued lighting. Obviously, a highly successful man and wife who are congratulating each other on a huge stock market killing. She being bosomy already, only aggravates things when she heaves a deep sigh and purrs, "Say stuff, pass me the snuff." The husband utters nary a word, but there is love light in his eye (lost one in a cigarette accident) as he passes her a silver jewel crested box. Whereupon she taps the top and with grace in every movement loads her lip with the amber goodness. No words are spoken. None needed. She slowly works the snuff deep into the roots of her pearly choppers. He looks on lovingly as ecstacy seems to drip from her every pore. Realizing there is no danger of losing the other eye from snuff, he takes her slowly in a long kissing embrace. With snuff, however, there are certain considerations. One must expectorate as well as breathe. As they break the clinch her speech seems garbled with emotion as she murmurs, "Mmmm-m, so smooth, so sweet—" Spitchowie! BONG! (She hits) and so-oooooooo accurate!

A Boon For The Air Lines

The air lines could really get behind this idea and promote it real big and come out way ahead. I'm sure they can see the advantages. They'd have healthier pilots and that's important. Once in a trip to the Home Office I got the straight word on this. An Assistant Personnel Manager told me: "A healthy employee is a productive employee." They wouldn't have to have "no smoking" signs on their planes and that would save all the cost of installing them. With the money they saved, they could install some really deluxe cuspidors on their preferential routes (spittoons on the others, of course). With the customers they would attract by this much-in-demand frill (after it has been properly promoted), I'll bet they could even do away with their flying saloons which they *say* they don't want anyway.

30 ALPA Employees Get Service Pins

At last count, the Association had 88 full-time employees, 30 in executive capacity and the remainder engaged in secretarial, stenographic, clerical and maintenance work. This full-time force is augmented by quite a sizeable part-time group. While new employees are constantly being added from time to time as the need arises, many of the current employees can point to lengthy periods of service with the Association, some in excess of 18 years.

In recognition of this, the ALPA Executive Committee recently approved ALPA Service Awards to be presented to ALPA employees. The awards are in the form of ALPA pins with ruby and diamond attachments indicating five-year intervals of service from 5 to 25 years. These awards were given out for the first time last month with 2 fifteen-year pins, 17 ten-year pins, and 11 five-year pins being presented. Viola Colby, Secretary to the President, and W. W. Anderson, Executive Assistant to the President were both awarded fifteen-year pins.

Ten-year pins were awarded to: S. A. Colvin, Administrator; T. G. Linnert, C. F. Eck, Engineering and Air Safety Dept.; E. C. Modes, Public Relations Dept.; J. C. Christie, F. J. Albright, Employment Agreements Dept.; V. J. Herbert, W. A. Schneider, Education and Organization Dept.; C. Rohles, Accounting Dept.; L. Cates, Legislative Representative; Dorothy Rubino, Membership; Alvera Fibiger, Lorraine Williams, Mary O'Hara, Accounting; Hazel Beckman, Legal; Betty Conner, Switchboard Operator; Ruby Svidron, Mailroom.

Five-year pins were awarded to: Pres. C. N. Sayen; F. H. Bennett, M. H. Schy, Legal Dept.; G. R. Johns, Council Dept.; L. Koch, Employment Agreements Dept.; H. M. Jones, Los Angeles Office; Fanny Hoenicke, Myrtle Danek, Accounting; Louise Basso, Personnel; Cecelia Martensen, Engineering and Air Safety; Marge Hoppe, Membership.

Human Relations In The Air: Communications

Communications Study Is No Monopoly Of Eggheads. It Is Important To Pilots Who Rely On It; In Fact, Often Bearing On The Success Of Human Relationships In Air Transport

By Capt. William Karraker
PAA

Are you getting the word? Do you think that everyone who doesn't understand you is a simpleton? Do you check your receiver before telling the other fellow that his transmitter is out of whack? How good a listener are you? All of these have an important bearing on successful communications.

Last summer, during a visit late at night to the Idlewild tower, I was treated to one of the most graphic examples, I've encountered, of a communications breakdown occurring when all facilities were operating normally, and when no one seemed at fault.

Here's what happened: CAA personnel were checking some newly-installed lights at the intersection of runways 4-22 and 7-25, and were on the active runway (25) with trucks and equipment. They were in contact with Ground Control on 121.9 mcs. My own company's flight 291 taxiied out to runway 25 for take-off under ground control and switched over to tower frequency for take-off clearance. There wasn't another aircraft near or on the airport in motion at that time of night. Flight 291 requested take-off clearance and was advised by the tower to taxi into position and hold. The tower operator then asked the ground controller to clear the intersection of CAA vehicles and personnel. While waiting word from the controller that the runway was clear, the tower transmitted to the aircraft: "AFTER TAKE-OFF MAKE A LEFT TURN OUT." The flight acknowledged and began to roll. The tower was about to tell the flight to discontinue the take-off when the ground controller advised that the runway was clear, and so Flight 291 departed without realizing that a hazard had existed.

The tower operator was baffled by the incident. I offered him what I think was an explanation of the series of events. The flight crew had simply heard what it *expected* to hear after being cleared into take-off position to hold. "AFTER" and "CLEAR FOR" are each two-syllable expressions with "FR" sounds in each syllable. What the flight must have heard was, "CLEARED FOR TAKE-OFF. MAKE A LEFT TURN OUT." Many of you who will probably recall similar experiences you have had or similar incidents you have observed.

A Failure Of Communications

Here, with no interference from other transmitters, no lack of ability in evidence anywhere, no evidence of "carelessness," was a failure in Communications which might have produced an aborted take-off or an accident.

Communication—by word, by gesture, or, by any other agreed signal—has been said to be essential to any form of human group activity. It is certainly basic to all human relationships in the air transport industry. I have related an isolated incident in tower/aircraft interaction. One of the most delicate features of an air line pilot's work is the giving and receiving of accurate information upon which action is to be taken.

It is generally agreed that the primary cause for delays around busy airports is *talk*—just plain, old chatter. In such crucial spots as Chicago and New York, it is difficult for us to realize, when we are using only one of the many radio frequencies available in the area, that the size of the overall communications network is appalling. One of us, reporting the vacating of an altitude or a holding pattern, causes transmissions to all aircraft above and around us who are headed for our altitude and fix. Delays in such reports delay all those other flights in like measure. The garrulous gaffer, who wants to discuss his particular peeve at great length with a controller, really holds up the works. And, while he chats, the airport weather may go below minimums.

The lingo for aviation communication needs to be standardized if ever one feature of our work needs to be. There should be a concerted effort to make standardized phraseology as foolproof as possible; concise, but clear. For example, the current phonetic alphabet is still a monstrosity. So was the old one we all still blurt out in emergencies. Down over Brazil one night last year, I heard a very much harried Air Force pilot trying to transmit a flight plan phonetically. I shan't burden you with other details, but the ground got Pilot Riley's name "Rilmy" because Echo for "E," sounds so much like Metro for "M." Other words of the flight plan were similarly messed up. How the poor "furriner" was helped by changing Fox to Foxtrot beats me. One of the clearest phonetics we had was Oboe (a musical term pretty generally known in which the letter symbolized was repeated twice). In its place we have been given Oscar, which the English pronounce "Ahskar" and the Latin group pronounce "Ohskar." Before I leave this subject, I think it is worth noting that a recent study at the University of Indiana on the subject of radio transmission indicated that stammerers were well understood because they pronounced most of the initial syllables of words twice. On that score Oboe, Papa, Alpha, and Mimi make good material. Each of them is two syllables long and repeats the sound of the letter symbolized.

Emotions

I am constantly struck by the emotional involvements associated with air/ground transmissions. These usually crop up when there is some technical interference to message interchange. Have you noticed that the receiving station will usually suggest that the station transmitting check his transmitter for modulation troubles, a squeal, or whatever? Rarely, if ever, does the proprietor of the receiver suggest that his receiver may be at fault.

An Allegheny pilot recently wrote to me concerning the problem of aircraft to aircraft interference on VHF in situations where one ground station cannot hear the transmissions of another ground station on the same frequency. For instance, the Pittsburgh tower is on 121.1mcs, as is Idlewild Departure Control. Neither the tower nor the controller can hear each other. But very often aircraft transmitting to the tower at Pittsburgh smear our reception from Idlewild. And I'm sure that we cause them some trouble on the same score. Frequently, the Idlewild controller sounds troubled because we don't hear him. As the Allegheny captain writes: "Ground stations do not understand that, if we answer them immediately, we may break up the other flight's ATC or prevent him from receiving weather. So they call

again in an exasperated manner." He points out that for his type of service (all VHF) the problem is nerve wracking.

The foregoing illustrations indicate that problems exist in Communications beyond the technical ones raised by faulty transmitters and receivers, by inferior condensers, and transistors. Technology is getting the lion's share of attention. It is rapidly outstripping man's ability to express ideas or information. The finest teletype system in the world will not function efficiently if the messages fed into it are poorly constructed, and if the readers of such messages are unable to decipher their content at least sufficiently well to take the action intended by the sender.

Systems And Language Habits

Much of the trouble behind non-technical communications failure lies in the types of systems available for use and in the language and other communications habits of senders and receivers of messages. Reasonable people will usually agree upon a course of action as soon as each finds out what the other has on his mind. They may agree to disagree, but the air will be clear. Problems of communication will be out of the way, off the agenda.

Stuart Chase, in the April, 1957, *Management Review* lists what he calls "Roadblocks to Communication." They are:

- The confusion of words with things.
- The careless use of abstract words.
- The confusion of facts with personal opinions.
- Judging people or events in terms of black or white.
- False identity based on words.
- Gobbledygook.

In dealing with these roadblocks the first step is to recognize them. I hope, by giving several examples of each in our field, to help the reader with this problem of recognition.

We hear a lot about flight safety, for example. Most people in the air transport industry seem to think they know what Flight Safety is. Each assumes that there is a physical thing that *is* Flight Safety. However, there is not only divergence between what a pilot, a CAA inspector or a member of air line management thinks is meant by Flight Safety, but often the public gets into the act and compels the closing of airports or certain runways in the interest of Flight Safety. So there is a *confusion of words with things.* Communication becomes difficult in the face of this roadblock. On the other hand, when an air line pilot and a CAA inspector discuss a specific practice (maybe, the desirability of humidity accountability in the certification of aircraft) the two men may agree to disagree, but they can point to several graphs dealing with performance, and may actually agree upon a test procedure. In resolving, or, compromising, their divergent positions, they can often contribute to Flight Safety without confusing the term, Flight Safety, with the processes which produce it.

Careless use of abstract words is akin to the previous roadblock. Should a check pilot be so inept in his job as to tell you that some procedure is "unsafe" and then leave you with no further detailed explanation, he hasn't communicated a thing. The only thing he's done is left you boiling mad. If instead, he refers you to a recent excellent article on "Landing Technique," issued by the Flight Safety Foundation, which indicates that very often a pilot, desiring from a public relations and self-satisfaction point of view to make every landing a "greaser," is creating a hazard by staying in the air too long and eating up runway, he may by such reference find an interested listener. The listener may be relieved to find that the neat touchdown isn't always the safe landing.

The roadblock *confusion of facts with personal opinions* is one we run into almost daily, in our own speech as well as in that of others. It is usually produced by too hasty generalization from too few observable facts. For example, there was a recent exchange of letters in *Aviation Week* following a news item in that magazine dealing with the Navy's blocking of all altitudes in Control Area 1150 (Miami, Fla. to Wilmington, N. C.) except 6,000—24,000 feet during maneuvers. Rancor developed all around between the pilots, the carriers, the CAA, and the Navy. The "facts" boiled down to a difference of opinion between the CAA and the Navy about the latter's being able to preserve the integrity of the unblocked altitudes by use of radar. Here was an honest difference of opinion between two groups of people, each group with a differing set of criteria and a different set of interests. The facts resolved themselves to the simpler vector that 1150 wasn't available to scheduled air transport during the maneuvers. Either the carriers used the longer inland route, or the Navy called off its maneuvers. There was nothing for which anyone could be blamed, blame being usually an emotional expression of personal opinion.

Dealing With Managers

Judging people and events in terms of black and white frequently troubles us in our dealing with our managers. If an employer takes the position that unions are bad, period, he will find life frustrating in today's world. He will particularly find it hard to talk to his employees, and to find out from them under what conditions they will work for him at optimum efficiency in their mutual enterprise. If, on the other hand, he recognizes that some unions have leaders who make the headlines by defrauding union members, by blackmailing employers, and by making "sweetheart" contracts; that other unions have made loans to employing companies and rescued them from bankruptcy; and, above all, that there are all sorts of union structures between these possible poles, he will find that life is not so cloudy, and that he can communicate profitably with his employee groups. Something we pilots can be wary of is the tendency to regard every utterance of the ATA people with hostility. This comes dangerously close to the attitude, "All employer associations are *bad*." What *facts* indicate blackness, grayness, and whiteness in each individual situation?

False Identification

False identity based on words was a roadblock highly fashionable in the days when the late Senator McCarthy was at the zenith of power and popularity. A syllogism often used ran something like this:

- Communists are against McCarthy.
- Most Democrats are against McCarthy.
- Therefore most Democrats are Communists.

Even though I'm an active member of our Republican Town Committee, I wouldn't use a thing like that on intelligent voters against the most unworthy opponent. Yet such a device was frequently used in the early 1950s to destroy people's reputations, and to win elections. That's below-the-belt punching.

This sort of thing gets into our industry when some of us say:

- All air line managers want to increase net profits.
- Longer pilot flight-time for less pay will increase profits.
- Therefore all air line managers want to cut our pay and fly us more.

Sometimes—sometimes, mind you—that's exactly the situation. But there is a group of managers, happily increasing in size, who are smart enough to

look to increased sales for those needed profits and who lean toward this type of syllogism:

- All air line managers want to increase net profits.
- Increased sales will usually increase profits.
- Therefore promote employee loyalty and enthusiasm for increased sales.

Gobbledygook is a term coined by the late Maury Maverick, Congressman from Texas, to describe the language of many public documents issued by Federal Agencies. It afflicts our lives today in that many Civil Air Regulations are couched in language that would defeat the proverbial Philadelphia Lawyer. When he faces such stuff, the average pilot stops reading material that could be important to his job. (To be frank, this writer has a hard time avoiding his own brand of Gobbledygook.) The term is so expressive that examples are hardly needed. They're all over the place.

Communication Snafus

USAF Captain Raigh Mason, writing in *Flying Safety*, that superb publication of the Flight Safety Research Branch of the Air Force, covers numerous particular cases of communications foul-ups which affected crew coordination and produced accidents.

He advises aircraft commanders:

"Remember, communications to your crew members (oral and visual symbols) are intended to bring out one particular response from them. If they "don't read you" you may become a flying safety statistic. When you order or gesture for a particular procedure to be accomplished, you are assuming that the following job components are clearly understood:

- *What* is to be accomplished?
- *Who* is to perform the action?
- *When* is the action to be executed? (Immediately or delayed?)
- *Where* is the action to take place?
- *How*, specifically, is the action to be accomplished?

"To an experienced crew, one that is well coordinated as a team, a word or a gesture may convey all of the above components. If flying with an inexperienced crew, or composite crew, however, such an assumption could be very hazardous. You must be certain that your cues, verbal or otherwise, cannot be misinterpreted."

Captain Mason states an ideal when he suggests that cues should never be subject to misinterpretation. Practically every cue can be misinterpreted unless senders and receivers of messages have established what is called, in fancy language, *rapport*. This word, for me, embraces what might be called good climate for communication; that is, when there is mutual respect between the people communicating, intelligent understanding of the language or other symbols used, and an organizational and technical situation which makes for a good flow of information.

These criteria for *rapport*, the good climate for communication, are worth more treatment than may be given them now. It is sufficient for the moment to point out that as mutual respect between communicators is lacking, chances for communication error increase. As respect of a copilot for his captain goes down, so will his interest in what his captain has to say go down. Lack of interest deteriorates alertness which, in turn, inhibits listening power.

Some taciturn captains operate solely with hand signals, and, the level of cockpit noise being what it is, there is sense in developing such signals for *some* purposes. But if other crew members do not know their silent friend's particular gesture jargon, certain problems may arise. In the field of communication—possibly more than in any other—there is a great need for standard cues.

Points Of Improvements

The organizational and technical situations in which air transport communications operate must be constantly maintained and improved. Noise (sound which does not contribute to transmission of messages) must be eliminated insofar as it is technically possible. Communications networks must be so tailored that the appropriate people get all the messages they need to do their work, and get no messages (which are in effect noise) that are not needed. At this point I may be forgiven if I cite the device which would represent for me the ultimate in a good technical situation for cockpit to outside world communication. It would be an airborne teletype device with a typewriter keyboard just like the one I'm using right now. It would be directed by a dial telephone type system. With plain old telephone technique I could dial anyone from the president of my company to the mechanic at the next station. I could look up his number in a directory, dial him, and then type out my message. He could reply through my machine just as soon as I threw the receiver switch. Such a utopian device could provide for storage of information until the machine was placed in a receptive condition, at which time it would beat out the stored messages. I cite this as a personal idea of a good technical situation for communications. There are thousands of others.

The study of communications is no monopoly of the Eggheads. It is a study which could well receive contributions from every working pilot. It so deeply affects Human Relationships that it is frequently the determining factor of the success of such relationships.

Bob Buck Directs TWA Jet Integration

Robert N. Buck, veteran TWA pilot, long-time ALPA member, and at present Supervisor of Flying for the International Division, has been appointed Special Adviser to the TWA President on the air line's jet integration program, according to an announcement by Pres. Carter L. Burgess.

Buck will survey and make recommendations on the activities of the company's jet committee and determine the status of the air line's jet planning and schedule of action with respect to jet integration, Burgess said. He will also institute plans for the adequate and effective flow of jet information to TWA's flight and ground personnel and review plans for jet training for all TWA personnel concerned with the program.

Buck last served as Alternate ALPA Region I Vice President. A member of the Association since 1938, he holds Membership Number 1544. Other Association offices held by Buck include Chairmanship of Council 24, member of TWA's negotiating committee, and ALPA representative at various industry meetings.

A native of Elizabeth, N. J., Buck began "flying" at the age of 15. He joined TWA in 1937 and became a Captain in 1940. During World War II he was engaged in special weather and research projects under a TWA contract with the Air Force. He served as Chief Pilot for TWA in 1945 and at present is Supervisor of Flying for the International Division.

He is a member of the Meteorological Sub-Committee of the National Advisory Committee for Aeronautics, the Institute of Aeronautical Sciences and the Institute of Navigation and is Associate Editor of *Air Facts* and contributing editor of the *Reader's Digest*.

FLYER'S FORUM

Fly VOR Centerline? Or, To The Right?

A Recent Article Suggesting Pilots Be Allowed To Fly To Right Of Centerline On VOR Airways Has Drawn Both Concurrence And Opposition. Here Is An Alternative Answer

By Capt. L. F. Abel, CAP
ALPA Representative, Washington Airspace Panel

The following is in reply to an article which appeared under "Flyer's Forum" in the June 1957 issue of THE AIR LINE PILOT. The author Capt. G. W. Henderson, UAL, indicated his disagreement with CAR 60.45, which requires a pilot to fly on the centerline of a VOR airway, and recommended that this regulation be changed to allow a pilot to fly a few degrees to the right of the centerline.

I share Capt. Henderson's concern about the number of aircraft coming towards me from dead ahead while flying the centerline of a VOR airway, and it is not unusual to observe numerous such aircraft during a climb to high altitudes. This situation is aggravated even further by inaccurate altimeters and the use of an autopilot-coupler which maintains what sometimes is a too precise track.

I am also in agreement with some of the advantages of flying to the right of the centerline as pointed out by Capt. Henderson, but feel that one important point has been overlooked, which might lead to an even more dangerous collision hazard under certain circumstances.

Fears Hazard

If Capt. Henderson's article should influence any air line pilot to adopt the practice of flying a few degrees to the right of the centerline while flying under actual instrument conditions in an area where two Victor airway radials diverge at 15 degree angles from the station, an extremely hazardous situation is created.

As you know, an air traffic controller may assign the same altitude to two aircraft on adjacent Victor airways when the airway radials diverge from the station by 15 degrees or more and the aircraft involved are a distance of more than 15 miles from the station. Our present VOR airway system has long been established using this criterion and the primary airways, as well as the alternate Victor airways used for climbing and descending, are designated in most cases with exactly 15 degrees lateral separation. With this airway pattern no vertical aircraft separation is necessary and climbs and descents through the altitudes of cruising aircraft may be made by utilizing the alternate VOR airways.

From the pilot standpoint this 15 degree lateral separation, with no vertical separation, is very critical.

Some time after this 15 degree lateral separation principle had been adopted and a large number of VOR airways already established, someone began thinking about the various errors possible in the VOR navigation system. The errors inherent in the ground station and the airborne receiver combined with the pilot's ability to fly the indicated centerline within certain tolerances posed some serious questions regarding the adequacy of the airway system. As a result, the Radio Technical Commission for Aeronautics formed Special Committee 62 to study the problem and I was asked to serve as ALPA's representative on this committee. After many months of deliberation and statistical analysis, which involved not only theory, but included laboratory bench checks of airborne receivers and 6,000 airborne checks by air line pilots on regular runs, this committee's report was published. The 15 degree lateral separation criterion was found to be adequate on the basis of probable errors (not malfunctions) in the VOR ground station and airborne receiver, but left only plus or minus 1½ degrees as the tolerance which the pilot was expected to adhere to in flying the indicated centerline. If this pilotage tolerance is adhered to, a 5 degree buffer zone between adjacent airways will be provided with a statistical probability of better than 99.9 per cent.

ALPA's Recommendation

ALPA has indicated for the record that a pilotage tolerance of plus or minus 1½ degrees is inadequate and has requested that when 15 degree lateral separation is being used by the traffic controller, both pilots shall be advised. CAA has not as yet deemed this advisory procedure feasible.

This is a case where the airway system had already been designed, and when the probable errors in the electronics equipment were analyzed, the pilot was left with certain pilotage tolerances he was expected to adhere to. ALPA's Air Safety Dept. is currently participating in Air Coordinating Committee discussions regarding future airway planning and it is the ALPA position that the pilot must be given first consideration, so that the electronics equipment and the airway structure is designed after the capability of the human being is taken into consideration and not vice versa.

The usual Flight Path Deviation Indicator or VOR course needle presentation in our cockpits will show a 20 degree scale with respect to the VOR course which has been selected. This means that the needle which is centered and the needle which rests on the last dot on the indicator represents a difference of 10 degrees.

From the foregoing it should be realized that the pilot is expected to adhere to rather critical tolerances in present-day airway flying.

The practice of flying a few degrees to the right of a VOR airway centerline may have some advantages under VFR weather conditions and in some locations, but when flying under actual instrument conditions with another airway which diverges only 15 degrees, the pilot had darned well better do his utmost to center that needle! This does not sanction the use of the VOR needle associated with the RMI indicator, because this system does not give VOR course information with the necessary degree of accuracy.

Another small disadvantage which would occur with the use of this right side philosophy would be the poor positioning at some Omni intersections. Many of our radio fixes are very poorly defined because they are predicated on an omni radial which intersects the course radial at an acute angle. Any deviation left or right from the course centerline results in an erroneous fix and an inaccurate position report which affects the efficiency of the air traffic control service provided.

While the VOR system is unquestionably more accurate than the LF system, it is possible that right side separation may not be effected as easily with the VOR. Barring a swinging range leg, a pilot could be fairly well assured that he was to the right of the LF centerline when he received the appropriate off-course signal—even though he might not know how far to the right. A study of the errors inherent in the VOR system will show that a pilot has no assurance that he is to one side or another of a precise course, and indeed, he may even be led closer to a collision course when he tries to outguess the system, than would be the case if he flew the indicated centerline and allowed the usual system errors to provide random separation.

Sees Step Backwards

In my opinion a return to the right side concept is a step backwards. I feel that we should concentrate instead on a revised airway structure designed around the pilot's ability to adhere to reasonable tolerance while coping with the ever increasing cockpit workload. The communications burden combined with the complexity of the existing doglegged airway structure and present-day aircraft speeds, leaves the pilot little time to concentrate on holding a precise course in many instances. I would personally like to erase the present airway map and start all over again.

While we must live for awhile longer with the present airway structure, an alternate to Capt. Henderson's recommendations might be the encouragement of greater use of the alternate Victor airway system by both pilots and controllers. This is an airway structure which is not fully utilized by controllers to expedite climbs and descents and might well be used advantageously by pilots when flying VFR.

Batter Up

New York Summer Festival Queen Pat Johnson takes a hefty practice swing as she prepares to christen American Airlines new non-stop DC-7 service between New York and St. Louis, August 11. (United Press Photo.)

Pilot In Air Equals 25 Men On Ground

From PLANES

A study by a major aircraft and missile producer has graphically demonstrated the superiority of man over the machine. The study found that by replacing one man in the air — the pilot — with electronic equipment, as many as 25 men are needed on the ground to do the same tasks.

Explaining this 25-to-1 ratio, a leading engineer put it this way: "In remotely human-controlled missiles you lose the pilot's kinesthetic feedbacks ('feel'), the visual cues, the auditory patterns — all the data for which no really effective substitute has yet been found."

In other words, the pilot still has more brains than a missile system.

No matter how fantastic the airplanes of the future may seem in terms of speed, range and altitude, it's a good bet they will still have a human being inside them, to "mind the store."

An Operating Concept For ATC Solutions . . .

(Continued from Page 6)

indication to show you which is your own "spike.") The spikes for any aircraft that are not equipped to report position and receive signals automatically will be slow coded (flash coded) to tell you that these are estimated positions based on voice reports over fixes. Wider separations and different rules will be applied to these aircraft as required.

You will realize that "seeing" the other aircraft on your own lane at your own altitude does not in itself constitute a system. What about changing altitude? And what about the problem where routes intersect? The answer: In the system proposed airspace assignments, fix to fix, altitude to altitude, and across intersections are interlocked on the same positive, *fail-safe* basis used in railroad practice and the pilot is given signal indications telling when the airway is clear for him to proceed. The signal is given the pilot by "flash coding" the stationary "spike" (on the right of the vertical trace) that is next ahead of his own aircraft indication on the left. A "steady" indication could mean "green light," you are clear to proceed beyond this fix. An "intermittant flash" could mean: prepare to hold or slow down to maneuvering speed. Continual flashing could mean "hold." A second "spike" can be added to the basic "fix-spike" and flash coded with "A" or "N" for climb or descent indication. All the information the pilot will need in routine operation can thus be given him in simple, visual form.

This is only the beginning—a description of the basic position reporting and signal indicating device. There is more. The pilot is given a switch to "look in on other altitudes." If he wants to go there, he presses a "request" button. The answer comes at once on the signal indication.

One of the most important characteristics of the system proposed, is illustrated in *Figure 5*. When one airplane wants to climb or descend through the altitude of another, this can be done on the basis of *distance* separation between the two aircraft just as it is done by radar. If there is a clear block in the altitude below the conflicting aircraft, this block is reserved for the upper aircraft which is then cleared down *two* altitudes, passing the other aircraft on the basis

of distance separation. This takes the place of the VFR climb or descent so often requested by the controller today. Even though the two airplanes are momentarily close together (in terms of block separation), each has at all times a reserved airspace big enough to hold in. If the system breaks down the maneuver will continue to completion safely.

Questions Answered

Now for some questions:

What if the airborne component fails? The ground equipment continues to hold the reserved airspace until the controller talks to the airplane by voice and reinserts him in the system like an unequipped aircraft. The pilot is alerted at once of the failure because he gets no signal (scope) indication unless all components are working properly.

What about failure of the ground elements? Ground equipment should be designed in such a way that failure of any kind will put out of service only small areas. The nature of the system is such that a safe status remains when the automatic system fails. The controller will still have in front of him enough information to manually unravel the traffic and hand carry it by the failed part of the system.

Are we stuck with fixed routes in the higher altitudes and the areas of lower traffic density? Definitely not. The same equipment components on the ground and in the air can be applied in a different mode of operation. The same principle of entering an airspace only when it is known to be already clear and after it has been reserved for your operation will still be used, but will be applied in a completely flexible way. Visualize, for example, that the same ground stations are used to create a grid pattern in the upper altitudes. Each block could be a square of say thirty miles on a side. (Ground stations can produce any number of blocks out to line of sight.) Once clear of the rigid track pattern necessary in the high density area, you can set into your airborne equipment a request to cross north-south grid lines to the west. Simultaneously you can request to cross east-west grid lines to the south. The signal will be modified to give you a "green light" to cross grid lines to the west *and* a second indication to tell you whether or not you are free to cross grid lines to the south. If both indications are "green," you can then fly any random course from west to south as long as both indications remain "clear." When another flight blocks the random track you are flying, you can call the ground for vector control past the other flight, or change altitude, or, with the help of

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your signal indicator, find the other flight visually and pass him by mutual agreement between you. You will have complete freedom in choice of track without the necessity for feeding a complex, advance plan into a giant electronic brain.

How long would it take to build and test such a system? To answer this question I turned to a scientist and engineer of outstanding reputation. Oscar Field (now retired) was vice president in charge of research and engineering for the General Railway Signal Company. Ten years ago Field built and successfully test flew a more complex system than I have described —a system based on the same principles. Field is perhaps better qualified than any person in the United States to tell us how long it would take to build and test the system I have proposed. In fifteen years of intimate acquaintance I have never known this man to underestimate a problem of this nature. He is conservative in the extreme. He said, "Such a system could certainly be built and all the essential elements placed in service test in less than one year if enough development money was provided to get the job done under high priority."

If Mr. Curtis and Mr. Pyle agreed to do it, the helicopter fleet of New York Airways (or one of the other helicopter operators) could be equipped and the ground stations installed to start service evaluation *in less than one year.*

Problems To Be Encountered

I have tried to tell you in this paper *what could be done to get air traffic rolling and to get some of the needed flexibility put back in the airways picture.* I think, however, that what I have described *will not come to pass* in the short time I have indicated possible. The reason: People with operating know-how—pilots, controllers, dispatchers — are not being brought into ATC development programs.

The difficult problems we face in air traffic control are not technical problems. The awkward, unsolved problems are questions of operating policy and practice. And as long as controllers and pilots are kept on the outside of the closed development door, it is not reasonable to expect progress. Worse, we are almost certain to get deeply committed in wrong directions.

Twelve years ago I tagged along with Ernie Cutrell while he talked with the slide rule artists about approach lights. Cutrell had probably done more low visibility flying than anyone else up to that time. Cutrell the pilot kept saying, "It must be simple. A centerline row of lights is best." So what did we get? We got slope line bars because the technical man in the driver's seat insisted that he knew more about what the pilots wanted than Cutrell.

It's not going to be as easy to change the configuration of the ATC boondoggle we're likely to get as it was to change slope line approach lights to a centerline system.

I will wind this up with a prediction: We are going to have another year or two of muddling around, with more studies and more promises by technical people who know little or nothing about air traffic control. At the end of a year or two of sharply increasing pressure, the ATA, the ALPA, the military and other operating agencies will suddenly wake up to two things:

One, they will come face to face with the fact that *radar is not the answer to everything.* A saturated or overloaded manual radar system is go-

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ing to be even worse than a saturated pencil scratching system.

And two, pilots and the various operating agencies will discover that we are faced with an air traffic control problem, not an academic exercise in mathematics. Maybe at this point the complete engineering domination of the ATC development program will come to an end. We might even go so far as to hire and train air traffic engineers. Today, when we have congestion on our highways, we call in a highway traffic engineer to tell us where to pour concrete. On the airways, for some strange reason, we hire an electronic engineer to tell us how to twist operating policy and practice to fit the gadgetry he hopes might work.

Unfortunately, by the time we have woken up to the true nature of the problem, we will probably have lost the golden opportunity we have now. Congress, which will in the interim have supplied large sums of money, will be disillusioned. It will not be easy to get money for the right things after the cream has been poured down the drain for boondoggles.

In fact, it may be that it is time for ALPA to kick a few doors down to get action, if that is what is necessary.

NACA . . .

(Continued from Page 8)

the Air Force and Navy are making good use of this rule, with gains in speed of as much as 25 per cent, without additional power, being secured.

Power Factor

Supersonic speed, of course, is dependent upon great amounts of power, and gratifying progress to this end has been made at the NACA's Lewis Flight Propulsion Laboratory in Cleveland. Similarly, supersonic speed imposes enormous air loads upon the airplane structure, and the NACA has significantly increased its research effort in this area.

At the present time the major research effort by the NACA is focused upon acquiring information necessary for achievement at the earliest possible moment of two goals: (1) airplanes speedy enough to shrink the globe until any two points will be within a comfortable, short day's journey (Peter Masefield has noted that the human frame is incapable of sitting comfortably for more than, say, four hours at a time), and (2) ballistic missiles that can travel the required distances at the desired velocities without being destroyed by aerodynamic heating.

The task of designing equipment that will be useful in conducting the necessary research has been formidable. The great difficulty has been in learning how to duplicate in the laboratory the extremely high temperatures and other conditions of future flight. Only recently have ways been found to design the small, pilot models with which to demonstrate the practicability of construction of the radical new tools so necessary.

In The Future

What of the future, what of the next 50 years? Again I quote from the inventors of the airplane, this time Wilbur Wright: "It is not necessary to look too far into the future; we see enough already to be certain that it will be magnificent."

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